Test answers - Circles: circumference and area

Year: Year 8 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Circumference $C = 2\pi r$ (1 mark for the formula). With $r = 9$: $C = 2 \times \pi \times 9 = 18\pi = 56.548\ldots$, which is **56.5 cm** to 1 decimal place (1 mark).
b. The area formula uses the radius, so halve the diameter first: $r = 14 \div 2 = 7$ cm (1 mark). Then $A = \pi r^2 = \pi \times 7^2 = 49\pi = 153.938\ldots$, which is **153.9 cm²** (1 mark).

A common mistake is using the diameter 14 in the area formula, which gives $196\pi \approx 615.8$ cm², four times too big. Another is working out $(\pi \times 7)^2$ instead of $\pi \times 7^2$. Estimate: $3 \times 49 \approx 150$, close to 153.9.

Answer to Question 2 (4 marks)

a. The circumference is $C = \pi d$, so the diameter is $d = C \div \pi = 37.68 \div 3.14 =$**12 cm** (1 mark). The radius is half of the diameter: $r =$**6 cm** (1 mark).
b. The area is $A = \pi r^2$, so divide by π first: $r^2 = 200.96 \div 3.14 = 64$ (1 mark). Then take the square root: $r = \sqrt{64} =$**8 cm** (1 mark).

Working backwards means undoing each operation in reverse order. Check (a): $3.14 \times 12 = 37.68$. Check (b): $3.14 \times 8^2 = 3.14 \times 64 = 200.96$. Remember to take the square root at the end; stopping at 64 gives the square of the radius, not the radius.

Answer to Question 3 (4 marks)

a. The diameter is 10 m, so the radius is 5 m (1 mark). A semicircle is half a circle: $A = \frac{1}{2} \times \pi \times 5^2 = 12.5\pi = 39.27\ldots$, so the area is **39.3 m²** (1 mark).
b. The curved edge is half of a full circumference: $\frac{1}{2} \times \pi \times 10 = 5\pi = 15.71\ldots$ m (1 mark). The perimeter also includes the straight edge, which is the diameter of 10 m, so the perimeter is $15.71 + 10 =$**25.7 m** (1 mark).

Forgetting the straight edge is the most common error and gives only 15.7 m. A gardener edging the flower bed needs both parts.

Answer to Question 4 (4 marks)

a. The tarmac is a ring: the large circle minus the grass island. Large circle

$\pi \times 5^2 = 25\pi \approx 78.5$ m²; island $\pi \times 3^2 = 9\pi \approx 28.3$ m² (1 mark for both areas). Tarmac area $= 16\pi = 50.265\ldots$, which is **50.3 m²** (1 mark).

b. Multiply by the price per square metre, using the unrounded area: $16\pi \times 28 = 1407.43\ldots$ (1 mark). To the nearest pound the cost is **£1 407** (1 mark).

Using the rounded area gives $50.3 \times 28 = £1\,408.40$, which is also accepted with full working. Subtracting the radii first, $\pi \times 2^2$, is wrong because a ring is not a circle of radius 2 m.

Answer to Question 5 (4 marks)

a. Change the diameter to metres: 70 cm = 0.7 m. The circumference is $\pi d = \pi \times 0.7 = 2.199\ldots$ m (1 mark for the formula), which is **2.20 m** to 2 decimal places (1 mark).

b. The journey is 2.5 km = 2 500 m. Each turn of the wheel moves the bicycle one circumference forward, so the number of turns is $2500 \div 2.1991\ldots = 1136.8\ldots$ (1 mark). The question asks for complete turns, so round down: **1 136 turns** (1 mark).

The 1 137th turn is not finished when Zane arrives, so it does not count as complete. Use the unrounded circumference: dividing by 2.20 gives 1 136.4, which leads to the same number of complete turns.